FREQUENTLY ASKED QUESTIONS
E. coli and Shiga toxin-producing E. coli (STEC)
Missouri Department of Health and Senior Services

What is *E. coli*?

Escherichia coli (abbreviated as *E. coli*) are a large and diverse group of bacteria. Although most strains of *E. coli* are harmless, others can make you sick. Some kinds of *E. coli* can cause diarrhea, while others cause urinary tract infections, respiratory illness and pneumonia, and other illnesses.

What are Shiga toxin-producing *E. coli*?

Some kinds of *E. coli* cause disease by making a toxin called Shiga toxin. The bacteria that make these toxins are called "Shiga toxin-producing" *E. coli*, or STEC for short. The most commonly identified STEC in North America is *E. coli* O157:H7 (often shortened to *E. coli* O157 or even just "O157"). When you hear news reports about outbreaks of "*E. coli*" infections, they are usually talking about *E. coli* O157.

In addition to *E. coli* O157, many other kinds (called serogroups) of STEC cause disease. These other kinds are sometimes called "non-O157 STEC."

What are the symptoms of STEC infections?

The symptoms of STEC infections vary for each person but often include severe stomach cramps, diarrhea (often bloody), and vomiting. If there is fever, it usually is not very high (less than 101˚F/less than 38.5˚C). Most people get better within 5–7 days. Some infections are very mild, but others are severe or even life-threatening.

What are the complications of STEC infections?

Around 5–10% of those who are diagnosed with STEC infection develop a potentially life-threatening complication known as hemolytic uremic syndrome (HUS). Clues that a person is developing HUS include decreased frequency of urination, feeling very tired, and losing pink color in cheeks and inside the lower eyelids. Persons with HUS should be hospitalized because their kidneys may stop working and they may develop other serious problems. Most persons with HUS recover within a few weeks, but some suffer permanent damage or die.

How soon do symptoms appear after exposure?

The time between ingesting the STEC bacteria and feeling sick is called the "incubation period." The incubation period is usually 3-4 days after the exposure, but may be as short as 1 day or as long as 10 days. The symptoms often begin slowly with mild belly pain or non-bloody diarrhea that worsens over several days. HUS, if it occurs, develops an average 7 days after the first symptoms, when the diarrhea is improving.

How are these infections spread?

Infections start when you swallow STEC—in other words, when you get tiny (usually invisible) amounts of human or animal feces in your mouth. Unfortunately, this happens more often than we would like to think about. Exposures that result in illness include consumption of contaminated food, consumption of unpasteurized (raw) milk, consumption of water that has not been disinfected, contact with cattle, or contact with the feces of infected people. Some foods are considered to carry such a high risk of infection with *E. coli* O157 or another germ that health officials recommend that people avoid them completely. These foods include unpasteurized (raw) milk, unpasteurized apple cider, and soft cheeses made from raw milk. Sometimes the contact is pretty obvious (working with cows at a dairy or changing diapers, for example), but sometimes it is not (like eating an undercooked hamburger or a contaminated piece of lettuce). People have gotten infected by swallowing lake water while swimming, touching the environment in petting zoos and other animal exhibits, and by eating food prepared by people who did not wash their hands well after using the toilet. Almost everyone has some risk of infection.

How are STEC infections diagnosed?

STEC infections are usually diagnosed through laboratory testing of stool specimens (feces). Identifying the specific strain of STEC is essential for public health purposes, such as finding outbreaks.

What is the best treatment for STEC infection?

Non-specific supportive therapy, including hydration, is important. Antibiotics should not be used to treat this infection. There is no evidence that treatment with antibiotics is helpful, and taking antibiotics may increase the risk of HUS. Antidiarrheal agents like Imodium® may also increase that risk.

How can STEC infections be prevented?

1. WASH YOUR HANDS thoroughly after using the bathroom or changing diapers and before preparing or eating food. WASH YOUR HANDS after contact with animals or their environments (at farms, petting zoos, fairs, even your own backyard).
2. COOK meats thoroughly. Ground beef and meat that has been needle-tenderized should be cooked to a temperature of at least 160°F/70˚C. It's best to use a thermometer, as color is not a very reliable indicator of "doneness."
3. AVOID raw milk, unpasteurized dairy products, and unpasteurized juices (like fresh apple cider).
4. AVOID swallowing water when swimming or playing in lakes, ponds, streams, swimming pools, and backyard "kiddie" pools.
5. PREVENT cross contamination in food preparation areas by thoroughly washing hands, counters, cutting boards, and utensils after they touch raw meat.

How do public health agencies investigate STEC outbreaks?

The Missouri Department of Health and Senior Services works cooperatively with local public health agencies when investigating disease outbreaks. Depending on the scope of the investigation, federal partners such as the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) also assist in the investigation.

When investigating a STEC outbreak, the first step is to develop a case definition which defines a case in time, person and place. A case definition is used to spell out which ill persons will be included as part of the outbreak. Case definitions may include details about:

- Features of the illness.
- The pathogen or toxin, if known.
- Certain symptoms typical for that pathogen or toxin.
- Time range for when the illnesses occurred.
- Geographic range, such as residency in a state or region.
- Other criteria, such as DNA fingerprint (if the pathogen is tracked by PulseNet).

Case definition may change as the investigation continues and public health staff learn more about characteristics that the ill people have in common.

When exposure to a food is suspected, the investigators next must consider the large number of foods that may be the source. The number of different food items is vast, so the investigation needs to narrow the list to the foods that the ill people actually ate before they got sick, and then further narrow it to the specific foods that many of the ill people remember eating. Investigators interview persons who are ill to find out where and what they ate in the days or weeks before they got sick. These interviews are called "hypothesis-generating interviews."

The time period they ask about depends on the pathogen's incubation period—the time it takes to get sick after eating the contaminated food. This varies for different pathogens. (The incubation period for *E. coli* O157:H7 is usually 3 to 4 days (range from 1 to 10 days). If the exposure occurred at a restaurant, hotel, or catered event, for instance, interviews will focus on the menu items prepared, served, or sold there.

From the interviews, investigators create a short list of the foods and drinks that many ill persons had in common. They cross off foods that none or very few of the sick people reported eating. One restaurant chain or one grocery store chain might be named more often than expected.

Investigators then look at other information, such as the laboratory results of any food testing, past experience with the suspected pathogen, and the age or ethnicities of ill persons.

Based on all the information they gather, the investigators make a hypothesis—**an educated guess**—about the sources of the outbreak.

A hypothesis must be tested to see if it's correct. Investigators use many methods to test their hypotheses. Two main methods are analytic studies and food testing.

Simply put, investigators analyze (study) information they collect from ill persons and comparable well persons (called a "control" group) to see whether ill persons are more likely than people who did not get sick to have eaten a certain food or to report a particular exposure. If eating a particular food is reported more often by sick people than by well people, it may be associated with illness. Using statistical tests, the investigators can determine how strong this association is, how likely it is to have occurred by chance alone, and whether more than one food might be involved

Food testing can provide useful information and help to prove a hypothesis. Finding bacteria with the same DNA fingerprint in an unopened package of food as in the stool samples of people in the outbreak can be convincing evidence of a source of illness. But relying on food testing can also lead to results that are confusing or unhelpful. This is the case for several reasons:

- Food items with a short shelf life are often gone by the time the outbreak is known, so they can't be tested.
- Even if the actual suspected food is available, the pathogen may be hard to find. It may have decreased in number since the outbreak. Other organisms may have overgrown it as the food has started to spoil.
- The pathogen may have been in only one portion of the food. A sample taken from a portion that was not contaminated will have a negative test result. So, a negative result does not rule out this food as a source of illness or the cause of the outbreak.
- Leftover foods or foods in open containers may have been contaminated after the outbreak or from contact with the food that actually caused the outbreak.

Sometimes in testing their hypotheses, investigators find no association between the illnesses and any particular food. This is not unusual, even when all the clues clearly point to foodborne transmission. In fact, investigators identify a specific food as the source of illness in only about half of the foodborne outbreaks reported to CDC.

When no association is found, it does not mean that the illness or outbreak was not foodborne. It means only that the source could not be determined. If the outbreak has ended, the source of the outbreak is declared unknown. If people are still getting sick, investigators must keep gathering information and studying results to find the food that is causing the illnesses.

**Source: Centers for Disease Control and Prevention*